Intro to Quadratic Relations

So far: Linear Relations	New: Quadratic Relations
Equation: $y = mx^1 + b$	Equation: ① $y = ax^2$ ② $+ bx + c$
m is slope, b is y-intercept	a, b, and c are coefficients
highest exponent of x is 1	highest exponent of x is 2 (degree, or order, of 2)
$y = 2x + 5$	$y = x^2 + 4x + 5$

Standard form

factored form

② $y = a(x-s)(x-t)$

③ $y = a(x-h)^2 + k$

Vertex form

Mar 20 - 4:17 PM

Recall: To graph a relationship, we can use a table of values (or TOV).

1. Pick some values for x.
2. Sub each x-value into the equation.
3. Determine values for y.
4. Plot each point (x, y) on the x-y plane.
5. (Optional) Calculate first differences, which are the differences between *consecutive* y-values for *consecutive* x-values.

Apr 14-7:45 PM

Create a TOV for y = 2x + 1

x	y = 2x + 1	$\Delta y = y_2 - y_1$
-2	$2(-2)+1 = -3$	
-1	$2(-1)+1 = -1$	$-1-(-3) = 2$
0	$2(0)+1 = 1$	$1-(-1) = 2$
1	$2(1)+1 = 3$	$3-(1) = 2$
2	$2(2)+1 = 5$	$5-(3) = 2$

(x, y)

(-2, -3)

'Δ' (delta) means "change in" or "difference".
Δy is the change in y, or the first difference.

In a linear relationship, the first differences are constant.

Apr 14-7:48 PM

Ex.1. Create a TOV for $y = x^2$

1st

2nd differences

x	$y = x^2$	Δy	$\Delta^2 y$
-2	$(-2)^2 = 4$		
-1	$(-1)^2 = 1$	$1-(4) = -3$	$-1-(-3) = 2$
0	$(0)^2 = 0$	$0-(1) = -1$	$1-(-1) = 2$
1	$(1)^2 = 1$	$1-(0) = 1$	$3-(1) = 2$
2	$(2)^2 = 4$	$4-(1) = 3$	

(x, y)

(-2, 4)

(-1, 1)

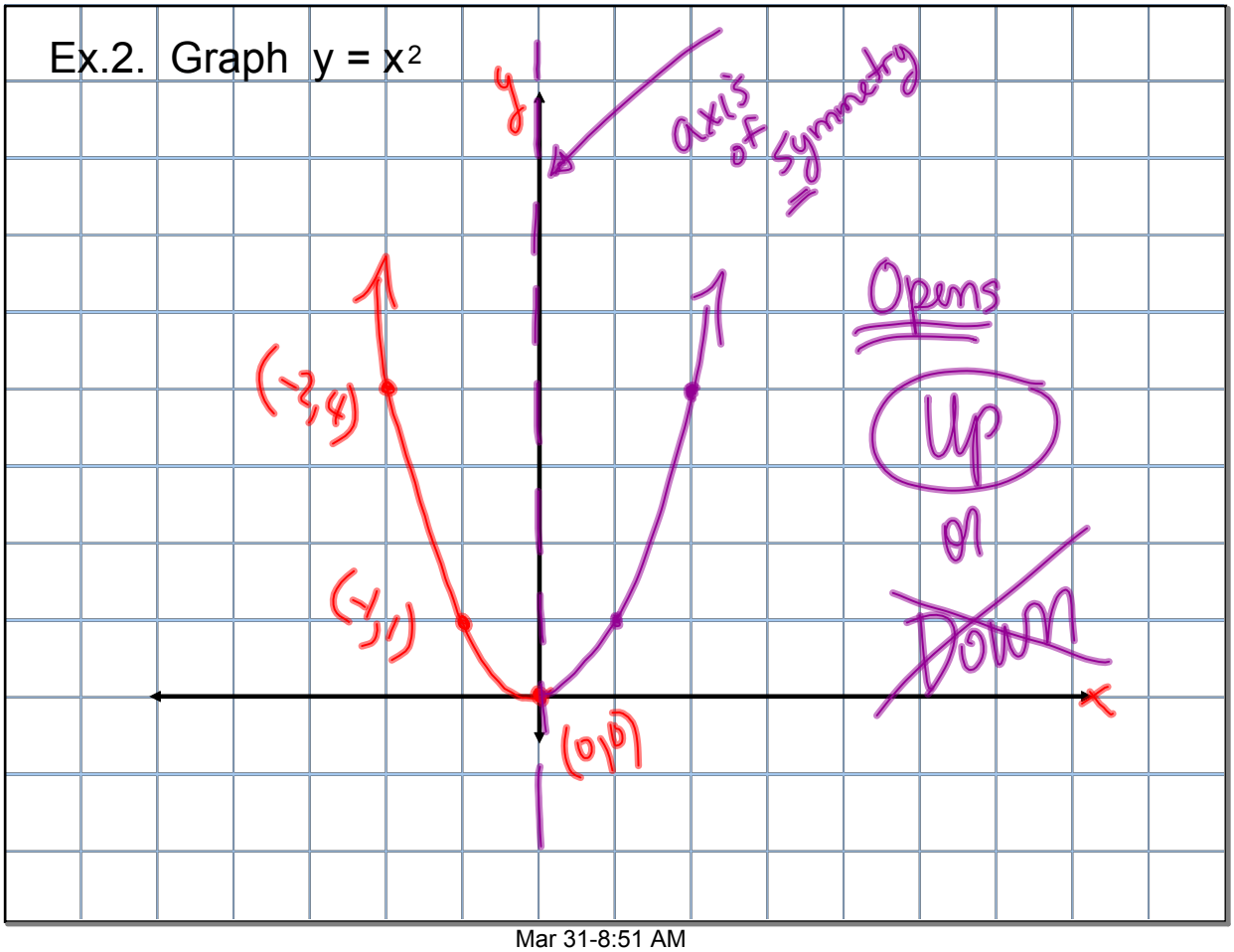
$\Delta^2 y$ is the change in Δy, or change in 1st differences.

$\Delta^2 y$ is the second difference.

In a quadratic relationship, first differences are different and second differences are ~~constant~~.

Apr 14-8:00 PM

Ex.2. Graph $y = x^2$



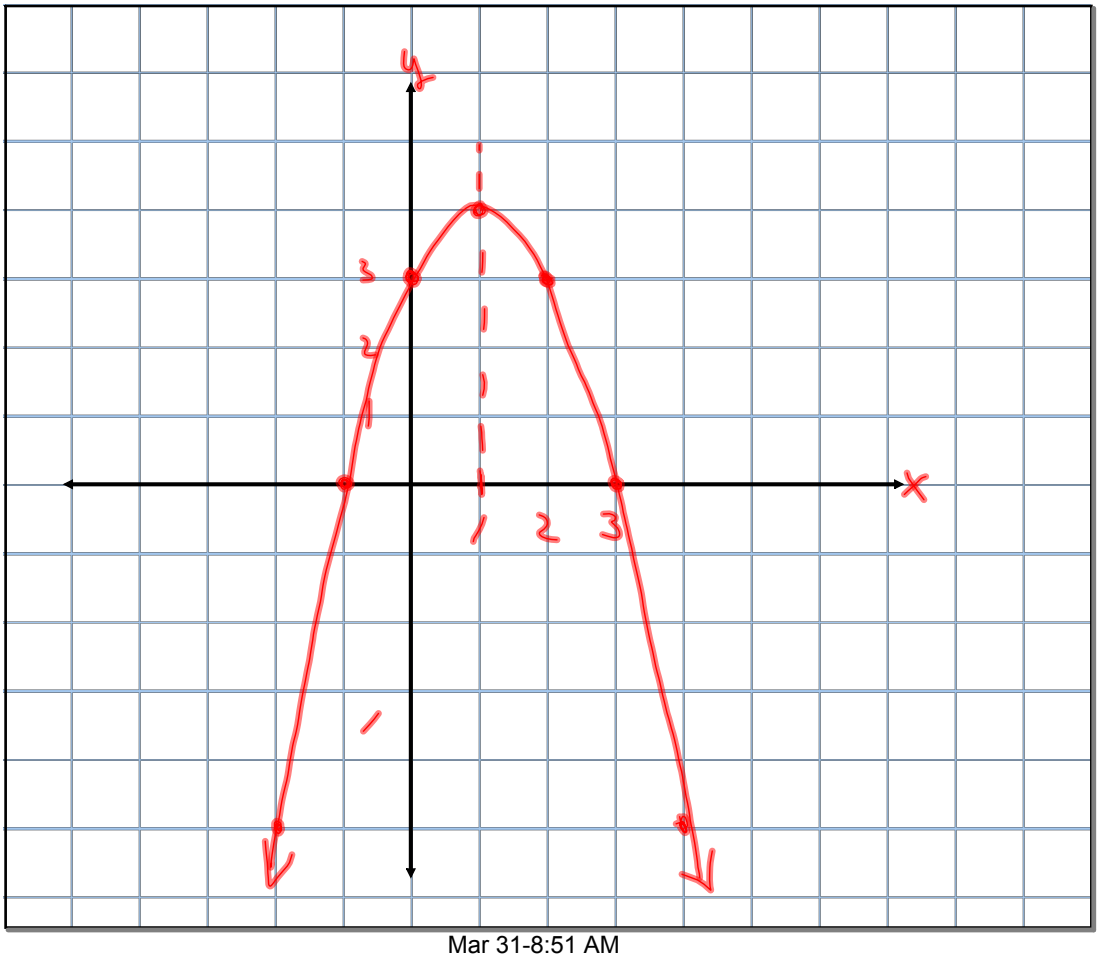
Mar 31-8:51 AM

Ex.3. Create a TOV and graph $y = -x^2 + 2x + 3$.

x	$y = -x^2 + 2x + 3$	Δy	$\Delta^2 y$
-2	$-(-2)^2+2(-2)+3=-5$		
-1	$=0$	$0-(-5)=5$	$3-(5)=-2$
0	$=3$	$3-(0)=3$	$1-(3)=-2$
1	$=4$	$4-(3)=1$	$-1-(1)=-2$
2	$=3$	$3-(4)=-1$	

Quadratic because 2nd differences are constant

Apr 14-8:10 PM



Mar 31-8:51 AM

For any parabola, $y = ax^2 + bx + c$, the direction of opening can be determined from:

- the graph $y = -100x^2$ (D)
- the sign of the 2nd difference
- the sign of "a"

$y = x^2$ (U)

$y = -x^2$ (D)

(U) $y = 2x^2 + 4x + 6$

Positive "a" value
Positive 2nd difference $\Rightarrow$ parabola opens up.

Negative "a" value
Negative 2nd difference $\Rightarrow$ parabola opens down.

Mar 20 - 4:57 PM

Assigned Work:

p. 137 # 1, 2, 3, 4, 5ab, 6, 7

Nov 1-8:01 AM